ECONOMICS BULLETIN

Oligopoly and financial structure revisited

Krishnendu Dastidar
Jawaharlal Nehru University

Abstract

In this paper we employ a two stage Cournot duopoly model where firms can obtain outside funds only to finance production plans; payouts to shareholders are not allowed. Debt, equity and capacity are chosen in the first stage and output is chosen in the second stage. In contrast to the existing literature in this area, we show firms always choose zero debt in equilibrium. The two important implications of our analysis are (a) while there are linkages between financial structure and product market decisions, these linkages have no real effect on the choice of optimal capital structure of a firm, and (b) the standard results in this area are not robust to model specifications.

I am indebted to Eric Maskin for guidance and encouragement. Discussions with Abhijit Banerjee, Sudipto Dasgupta, Peter Eso, Shanto Ghosh, James Friedman, Claudio Mezzetti, Dipankar Sengupta and Kunal Sengupta have been very helpful. I must also thank John Wooders, an editor of this journal and an anonymous referee for an excellent set of comments. The usual disclaimer applies.

Citation: Dastidar, Krishnendu, (2003) "Oligopoly and financial structure revisited." *Economics Bulletin*, Vol. 12, No. 3 pp. 1−12

Submitted: November 13, 2003. **Accepted:** November 14, 2003.

URL: http://www.economicsbulletin.com/2003/volume12/EB−03L10016A.pdf

1 Introduction

Models of capital structure that use features of industrial organisation started appearing in the literature over the past decade and a half. The literature has mainly evolved around the pioneering paper of Brander and Lewis (1986). Abstracting from the well known determinants of capital structure, these models show that firms with limited liability will choose a positive amount of debt in equilibrium. Leverage makes a firm more aggressive in quantity competition and this gives debt a strategic advantage.

In this paper we provide a modified framework of the interaction between the financial structure and output market decisions of firms with *limited liability.* In particular, we employ a variant of the Brander and Lewis (1986) type Cournot duopoly model where debt, equity and capacity are chosen in the first stage and output is chosen in the second stage. In our framework firms can only obtain outside finance to finance production plans; payouts to shareholders are not allowed. In contrast to the existing literature in this area we show firms will always choose zero debt in equilibrium. Two important implications of our analysis are (a) while there are linkages between financial structure and product market decisions, these linkages have no *real* effect on the choice of optimal capital structure of a firm, and (b) the existing results are not *robust* in the sense that a slight modification of the model changes the results quite dramatically.

1.1 A Brief Literature Review

The modern *theory of capital structure*, as it stands today, began with the celebrated paper of Modigliani and Miller (1958). Till the mid 1980s, the industrial organisation literature assumed that in choosing its competitive strategy the firm's objective is to maximise total profits. The finance literature, on the other hand, focussed on maximisation of equity value while generally ignoring product market strategy. The linkages between financial and output market decisions were largely ignored until Brander and Lewis (1986).

Their pioneering paper considers a homogeneous product duopoly in which financial and output market decisions follow in a sequence. Brander and Lewis (1986) show that any firm, with limited liability, competing in a Cournot framework with an exogenous demand shock would always find it optimal to become leveraged. The *limited liability* nature of debt forces a firm to behave more aggressively in the product market. In recent years a number of papers like Maksimovic (1988), Glazer (1994), Campos (1995), Showalter (1995) and Dastidar and Sengupta (1998) have formalized the ways in which product market decisions may both influence and be influenced by corporate financing decisions. Most of these papers operate within the framework of Brander and Lewis, 1986 (henceforth called B-L). However there are a few inconsistencies in this framework. Some of them have been discussed in Dasgupta and Titman (1996) and Faure-Grimaud (2000).

The purpose of this paper is to suggest a modified framework, derive certain results and compare them with the existing results.

2 The Standard Story and its Problems

2.1 The standard story

Consider a homogeneous product duopoly where each firm is owned by a group of risk neutral shareholders protected by limited liability, who may turn to outside investors to finance production instead of only using equity capital. It is assumed that firms can raise funds in a competitive capital market. In such a capital market a group of debtholders with identical outside options is willing to supply firm i with a loan with face value D^i, which is payable once the product market profits have been called in.

In stage 1 each firm chooses a level of debt in order to maximise its expected total market value, where total value is equity value plus debt value. Debt is understood, in general, as any kind of monetary obligation which the firm must pay back before dividends can be distributed to shareholders. In the second stage the firms choose output levels taking as given the debt levels chosen in the first stage. Here it is assumed that the manager of the firm is free to choose whatever output level he desires after debt is issued. In the second stage output is chosen to maximise expected returns to the shareholders. The equilibrium concept is sequentially rational Nash equilibrium in debt levels and output levels. In other words, the second stage outcome is a Cournot equilibrium in output which is correctly anticipated by firms when choosing debt levels in the first stage. The output decisions of firms are made before the realisation of a random variable reflecting variation in demand. Once profits are determined, firms are obliged to pay debt claims out of operating profits, if possible. If profits are insufficient to meet the debt obligations, the firm goes bankrupt and its assets are turned over to the debtholders.

In this set up and under certain general assumptions B-L derives two basic results. (i) In the financial stage of the game, both firms will always select a positive level of debt because it has a strategic effect on rival's output. (ii) The second result is precisely this strategic effect: as a consequence of the protection offered to shareholders by limited liability, the behaviour of a leveraged firm in the product market is more aggressive relative to that of an unleveraged firm.

2.2 The Problems

The above story has a few weaknesses. The first result, mentioned above, is not necessarily true. Campos (1995) has shown with the help of an interesting counter-example that zero debt can arise in equilibrium. Dastidar (1999) generalises the Campos counter-example and provides the more correct version of the main B-L result.

More importantly, this framework has other problems. Firstly, nothing in the standard model ensures that the debt taken do not exceed the financing requirements. If in equilibrium, the debt taken exceeds the financing requirements, one needs a convincing story of how these extra funds are utilised. One such possible story is that, the shareholders of a firm can decide to "leverage up" by having the firm issue debt and simply distribute the money to the shareholders. Leveraged recapitalisations are observed sometimes in practice, for example as anti- takeover measures, and the money that is obtained from (new) lenders is not invested, but transferred to shareholders.

Secondly, it is also not very clear how D^i (the face value of debt) is determined. Note that D^i is the face value of debt which the firm promises to pay back out of operating profits, if possible. There is no mention of the amount of funds that a firm *actually receives* (the market value of debt) from the debtholders, which are used to finance the capital investment[1]. Two related contributions which also discuss some of the above mentioned problems of the above framework are Dasgupta and Titman (1996) and Faure-Grimaud (2000). The paper by Dasgupta and Titman (1996) extends Showalter (1995) criticisms to the static nature of the B-L approach and shows that the analysis of the product market and financial interaction in oligopolies make more sense in dynamic settings. In fact, they also discuss the role of initial capital requirements and the need of a fixed investment and show how B-L results may change. Faure-Grimaud (2000) also supports the need of distinguishing between market value and face value of debt and points out the failure of the standard framework in doing so. However, these papers are set in an optimal contract setting and the results are also very different from ours.

In view of the problems in the standard model we suggest the following framework.

3 The Modified Framework

Consider the following scenario in a symmetric cost, homogeneous product duopoly. Each firm is owned by a group of risk neutral shareholders protected by limited liability. Firm i has an initial equity capital of A^i. Each firm wants to set up a capacity level K^i. The cost for setting up K^i level of capacity is cK^i. If it is the case that $cK^i > A^i$ then firm i has to turn to outside sources for financing the cost of capacity creation. Each firm has two options. It can finance costs either through debt or through floating new equity or both. In case of debt finance, a firm receives D^{m^i} (the market value of debt) and promises to pay back D^i (the face value of debt) with limited liability. Floating new equity means that a part of the firm is being sold (the new equity holders become part owners in proportion to their share of equity capital to the total equity stock). Debt as before, is understood, in general, as any kind of monetary obligation which the firm must pay back before dividends can be distributed to shareholders. We assume that firms can only obtain outside funds to finance production plans; payouts to shareholders are not allowed.

We consider the following two stage game. In the first stage each firm chooses the level of capacity to be set up and also the amount of debt and/or new equity (if required) to finance such capacity build up. It is assumed that a firm can produce upto capacity at zero cost. In the second stage the firms choose output levels subject to the capacity constraint and compete in the Cournot way. In this stage output is chosen to maximise the return to the shareholders. The output decisions of the firms are made before the realisation of a random variable reflecting variation in demand. Once revenues are determined, firms are obliged to pay debt claims out of revenue, if possible. If revenues are insufficient to meet

[1] However, it should be mentioned here that equityholders in B-L do effectively internalise the costs that debtholders suffer from any risky actions they take in the product market because in their model equityholders maximise the total firm value (debt value + equity value) in the first stage. Thus any reduction to debtholders returns is felt by equityholders, similar to a reduction in the market value of debt if they were only maximisimising equity value.

debt obligations, the firm goes bankrupt and its assets are turned over to the debtholders[2]. The game is solved backwards; the first stage equilibrium capacity, debt and/or equity levels are determined using second-stage results. In the first stage, the firms choose capacity, debt and equity to maximise returns to the shareholders (i.e. the equity value) only. Recall that in the standard model the first stage objective function is maximisation of total value. However, it may be noted, total value maximisation makes sense only in a B-L set-up where the market value of debt is not included. Maximising total firm value is then needed so that equityholders are forced to internalise any actions that reduce returns to debtholders.

Note that our framework clearly points out what is the financing requirement and how the financing is being carried out. Financing requirements are determined by choice of capacity and if the existing equity stocks are insufficient to finance such costs then firms go for debt and/or new equity. We also make clear, in case of debt finance, how much a firm receives (it receives D^{m^i}, the market value) and how much it promises to pay back (it promises to pay back D^i, the face value). In the model we explicitly discuss how (given risk neutrality of debtholders) the face value of debt (D^i) is determined. We will later see, a firm always choose zero debt in equilibrium.

Here it may be mentioned that the existing finance literature on capital structure examines many factors influencing the choice of debt. The most standard treatment involves trading off the tax advantages against the bankruptcy costs in determining the optimal debt-equity mix. Also, some analysts have stressed the use of capital structure to signal information about the firm to investors. In this paper, we abstract from these well -understood determinants of capital structure and focus on that motive of holding (or not holding) debt which derives from the strategic aspects of leverage in relation to output markets.

We now provide the model of our exercise.

4 The Model

4.1 The set up

There are two symmetric limited liability firms in a homogeneous product market, each owned by a set of risk neutral shareholders. Each firm has an initial equity capital A^i. In the first stage both firms decide simultaneously on capacity levels, K^1 and K^2. In doing so they incur costs of cK^1 and cK^2 respectively[3]. In this stage they also simultaneously choose debt and/or equity which are used to finance the cost of capacity creation. Firm i takes debt of market value $D^{m^i} \geq 0$ and promises to pay back the face value D^i. It also raises new equity capital $Y^i \geq 0$ and promises to pay back $\left[\frac{Y^i}{A^i+Y^i}\right]\left[E\{\max(\text{Revenue } - D^i, 0)\}\right]$ to the new equity holders. Note that $E[.]$ refers to the expected value. Also note that the new equity holders own the fraction $\left[\frac{Y^i}{A^i+Y^i}\right]$ of the firm. Hence they have to be paid back this fraction of the total returns after the face value of debt (D^i) has been paid. In the first stage all

[2] Like B-L we assume that asset values are normalised to zero.

[3] In Industrial Organisation Theory there is huge literature on two stage games where capacity is chosen in the first stage. They stem out mostly from Spence(1977) and Dixit (1980). The game we consider is qualitatively different from this.

choices are made subject to the constraint $D^{m^i} + Y^i = \max\{cK^i - A^i, 0\}$ [4]. As noted before, we assume that firms can only obtain outside funds to finance production plans; payouts to shareholders are not allowed.

In the second stage each firm chooses production levels, $q^i \leq K^i$ and compete in the Cournot way to maximise the returns to the shareholders. For simplicity, it is assumed that the firm can produce upto capacity at zero cost and it cannot produce beyond capacity. The capacity is binding. Let r be the going competitive rate of interest and this represents the identical outside option for everybody.

Let $R^i(q^i, q^j, z)$ be the revenue accruing to the ith firm, where the random variable $z \in [\underline{z},\ \overline{z}]$, which has the density function $f(z)$ and distribution function $F(z)$. This reflects the effects of an uncertain environment on the fortunes of firm i. The value of z is realised only after actual sales take place. In other words, the firms choose quantities q^i and q^j and then revenues are realised.

We assume that R^i satisfies the usual properties :

$R^i_{ii}(.) < 0,\ R^i_j(.) < 0\ and\ R^i_{ij}(.) < 0$ (subscripts denote partial derivatives. For example, $R^i_{ij}(.) = \frac{\partial^2 R^i}{\partial q^i \partial q^j}.$). We also assume that $R^i_z > 0$ and $R^i_{iz} > 0$. It means that higher realisations of state z corresponds to higher revenue and higher marginal revenue. These assumptions are similar to the standard model.

In the second stage the firms choose quantities subject to the first stage capacity constraint to maximise the shareholders' expected return. For firm i this is equal to the following :

$$H^i = E[\max\{R^i(q^i, q^j, z) - D^i,\ 0\}]\ where\ q^i \leq K^i.$$

As before, in the above expression $E[.]$ stands for the expected value. The above indicates that after production and sales take place and the uncertainty regarding the firm's revenue is settled, the firm is obliged to pay creditors D^i out of its current revenue. If the firm is unable to meet its debt obligations, its creditors are paid whatever revenue is available and the shareholders get zero. Note that

$$H^i = \int_{\hat{z}^i}^{\overline{z}} [R^i(q^i, q^j, z) - D^i] f(z) dz. \qquad (1)$$

In the above $\hat{z}^i(q^i, q^j, D^i)$ is the critical bankruptcy threshold of z such that firm $i's$ revenues are just enough to repay its outstanding debt . That is, we have the following :

$$R^i(q^i, q^j, \hat{z}^i) = D^i. \qquad (2)$$

The following may be noted.

$$\frac{d\hat{z}^i}{dD^i} = \frac{1}{R^i_z(\hat{z}^i)} \qquad (3a)$$

[4]If $c^i K^i \leq A^i$, then immediately it follows that $D^{m^i}, Y^i = 0$. Debt and new equity are floated only if the initial equity capital (A^i) is insufficient to finance desired capacity creation costs.

$$\frac{d\hat{z}^i}{dD^j} = 0 \qquad (3b)$$

$$\frac{d\hat{z}^i}{dq^i} = \frac{-R^i_i(\hat{z}^i)}{R^i_z(\hat{z}^i)} \qquad (3c)$$

$$\frac{d\hat{z}^i}{dq^j} = \frac{-R^i_j(\hat{z}^i)}{R^i_z(\hat{z}^i)} \qquad (3d)$$

4.2 Determination of the face value of debt

In the first stage the debt holders have given firm i a sum of D^{m^i}. Since they are risk neutral they should set a D^i such that they can expect to be paid back $D^{m^i}(1+r)$. If D^i is the face value of debt, after the second stage the debtholders can expect to be paid back the following amount.

$$W^i = \int_{\underline{z}}^{\hat{z}^i} R^i(q^{i^*}(K^i),\ q^{j^*}(K^j),\ z)f(z)dz + D^i(1 - F(\hat{z}^i)) \qquad (4)$$

In the above $q^{i^*}(K^i)$ represents the equilibrium choice of output in the second stage. The first term in (4) represents the revenue of the firm in states of the world when this revenue is insufficient to completely cover debt obligations. The second term represents those states of the world in which the creditors of the firm are paid in full. Now, since the debt holders are risk neutral D^i should be such so the following is true.

$$\begin{aligned} W^i &= \int_{\underline{z}}^{\hat{z}^i} R^i(q^{i^*}(K^i),\ q^{j^*}(K^j),\ z)f(z)dz + D^i(1 - F(\hat{z}^i)) = D^{m^i}(1+r) \\ \Rightarrow\ D^i &= \frac{D^{m^i}(1+r) - \int_{\underline{z}}^{\hat{z}^i} R^i(q^{i^*}(K^i),\ q^{j^*}(K^j),\ z)f(z)dz}{1 - F(\hat{z}^i)} \qquad (5) \end{aligned}$$

The following derivative may be noted.

$$\frac{dD^i}{dD^{m^i}} = \frac{1+r}{1 - F(\hat{z}^i)} \qquad (6)$$

While computing the above derivative we used equation (2) which is given by $R^i(q^i, q^j, \hat{z}^i) = D^i$.

5 The Main Results

5.1 Equilibrium in the second stage

In the second stage firm i chooses q^i to maximise

$$H^i = \int_{\hat{z}^i}^{\bar{z}} [R^i(q^i, q^j, z) - D^i] f(z) dz \ \ \textit{such that } q^i \leq K^i.$$

$$\textit{Let } \beta(q^j) = \arg\max_{q^i \geq o} H^i \textit{and let } \lambda(q^j) = \arg \max_{K^i \geq q^i \geq 0} H^i$$

$$\textit{Clearly } \lambda(q^j) = \min \{K^i, \ \beta(q^j)\}$$

Now $\beta(q^j)$ is the solution in q^i of the following.

$$H_i^i = \int_{\hat{z}^i}^{\bar{z}} [R_i^i(q^i, q^j, z) f(z) dz \ = 0 \qquad (7)$$

Given strict concavity of R^i, $\beta(q^j)$ will be single valued and continuous and so will be $\lambda(q^j)$.

Clearly an equilibrium always exist and we denote it by $q^{i^*}(K^i)$ (where $i = 1, 2$). Note that, like B-L we have $\frac{dq^{i^*}(K^i)}{dD^i} > 0$ for $q^{i^*}(K^i) < K^i$. Hence we come to our first result which is very similar to Proposition 1 of B-L.

Proposition 1 Given our assumptions, the second stage Nash equilibrium output levels $q^{i^*}(K^i)$ are increasing in debt levels D^i, provided $q^{i^*}(K^i) < K^i$. If $q^{i^*}(K^i) = K^i$, then the equilibrium output levels do not change when D^i increases.

Proof The proof follows immediately from Proposition 1 of Brander and Lewis (1986).■

The above result shows that more leverage makes a firm more aggressive in output competition in the second stage.

5.2 Subgame perfect equilibrium

As discussed before we take equity value maximisation to be our objective function in the first stage. The equilibrium concept is sequentially rational Nash equilibrium in debt, equity, capacity (chosen in stage one) and output levels (chosen in stage two). In other words, the second stage outcome is a Cournot equilibrium in output (subject to capacity constraints) which is correctly anticipated by firms when choosing debt, equity and capacity levels in the first stage. Note that since r is the going competitive rate of interest, it represents identical outside option for everybody.

When an outsider invests Y^i in a firm (i.e buys equities) he expects a payoff of $\left[\frac{Y^i}{A^i+Y^i}\right] H^i$. Here $\left[\frac{Y^i}{A^i+Y^i}\right]$ is the fraction of the firm owned by him and H^i is the total return to the equityholders. Now he will invest Y^i in the firm only if

$$\frac{Y^i}{A^i+Y^i} H^i \geq Y^i(1+r) \Leftrightarrow H^i - (1+r)(Y^i + A^i) \geq 0.$$

Also note that the total financing requirements have to be met. That is, we must have $D^{m^i} + Y^i = \max\{cK^i - A^i, 0\}$.

$$Let \ \max\left\{cK^i - A^i, 0\right\} = M \qquad (8)$$

Note that,

$$\begin{aligned} \frac{dM}{dK^i} &= 0 \ for \ K^i < \frac{A^i}{c} \\ &= c \ for \ K^i > \frac{A^i}{c}. \end{aligned}$$

The objective function of the firm in the first stage is to maximise

$$H^i = \int_{\hat{z}^i}^{\overline{z}} [R^i(z) - D^i] f(z) dz$$

$$s.t. \ H^i - (1+r)(Y^i + A^i) \geq 0 \ and \ D^{m^i} + Y^i = M.$$

The choice variables are K^i, $D^{m^i} and \ Y^i$. The relevant Lagrangean is

$$\begin{aligned} L = \int_{\hat{z}^i}^{\overline{z}} [R^i(z) - D^i] f(z) dz \quad & +\lambda_1 \left[\int_{\hat{z}^i}^{\overline{z}} [R^i(z) - D^i] f(z) dz - (1+r)(Y^i + A^i) \right] \\ & +\lambda_2 \left[D^{m^i} + Y^i - M \right] \end{aligned}$$

where $\lambda_1, \lambda_2 \geq 0$.

The Kuhn-Tucker conditions for maximisation are the following.

$$\frac{dL}{dD^{m^i}} = -(1+r)(1+\lambda_1) + \lambda_2 \leq 0 \qquad (9)$$

$$D^{m^i} \left(\lambda_2 - (1+\lambda_1)(1+r)\right) = 0 \qquad (9a)$$

$$\frac{dL}{dY^i} = -\lambda_1(1+r) + \lambda_2 \leq 0 \qquad (10)$$

$$Y^i\left(-\lambda_1(1+r)+\lambda_2\right)=0 \qquad (10a)$$

$$\frac{dL}{dK^i}=(1+\lambda_1)\int_{\hat{z}^i}^{\overline{z}} R_i^i(z)f(z)dz-\lambda_2\frac{dM}{dK^i}\leq 0 \qquad (11)$$

$$K^i\left((1+\lambda_1)\int_{\hat{z}^i}^{\overline{z}} R_i^i(z)f(z)dz-\lambda_2\frac{dM}{dK^i}\right)=0 \qquad (11a)$$

Note that in a subgame perfect equilibrium $q^{i^*}(K^i)=K^i$ because any choice of $K^i>q^{i^*}(K^i)$ does not increase payoffs. Hence, $\frac{dq^{i^*}(K^i)}{dK^i}=1$. It may also be mentioned here that while computing the above derivatives we used equations (2), (3a)-(3d) and (6). Now we come to our main result.

Proposition 2 In the sequential game where debt, equity and capacity are chosen in the first stage and output is chosen in the second stage, the optimum debt taken will be zero and the entire financing will be done through equity only.

Proof From (10), we get that $(-\lambda_1(1+r)+\lambda_2)\leq 0$. Using this in (9) we get that $\frac{dL}{dD^{m^i}}<0$. This implies (from 9a) that in equilibrium D^{m^i} is zero.■

Comment This result stands in contrast to the standard literature. In their paper B-L show that firms always take positive debt in equilibrium. The reasons for the difference in our result with the standard ones in the literature are as follows.

In the standard model, at the second stage, the manager of the firm is free to choose whatever output level he desires after debt is issued. Also, the objective function in the first stage is maximisation of total value (H^i+W^i). Debt value (W^i) increases with D^i. However, D^i affects equity value (H^i) in two ways. As a direct effect H^i decreases with D^i. Indirectly, however, D^i has a positive effect. As noted before (Proposition 1), debt (or leverage) creates an incentive to increase output in the second stage. In Cournot oligopoly models, firms have an incentive to commit to producing large outputs since this causes their rivals to produce less. Leverage thus provides a device that allows firms to commit to producing more in the Cournot oligopoly and this gives the positive strategic affect of debt on equity value. In this standard model the strategic indirect effect of debt on H^i dominates the direct effect of debt on (H^i+W^i) for small levels of debt. As a result, both firms choose positive debt in equilibrium.

On the other hand, in our model, capacity choice in the first stage restricts output choice in the second stage. Also the first stage objective function is maximisation of equity value only. In our model, the direct effect of debt dominates the indirect strategic effect for all levels of debt. Though debt makes a firm more aggressive in quantity competition in the second stage, taking debt only serves to lower returns to the equity owners in the first stage. Therefore, in equilibrium we observe zero debt. As a result, the firms will be completely equity financed.

It may be noted that our framework derives the results by considerably changing the strategic situation. Essentially, in a subgame perfect equilibrium, output levels are chosen at the first stage (costly capacity choice), not at the second stage (costless production of output, subject to capacity constraints). *Simultaneously,* the firms make their borrowing decisions - this “kills” the risk shifting that drives the results in B-L and other related papers. In these papers, the sequential decisions (first borrowing, then output choice) mainly drive their result. In our model, capacity expansion is costly, and beyond the Cournot level it has no advantages, so the “limited liability effect” vanishes here.

6 Conclusion

Models of capital structure, which evolve around Brander and Lewis (1986) and use features of industrial organisation, fall in the class of exceptions to the Modigliani-Miller theorem. Abstracting from the well known determinants of capital structure, these models show that firms with limited liability choose a positive amount of debt in equilibrium. Leverage makes a firm more aggressive in quantity competition and this gives debt a strategic advantage. In this paper we argue that these models have certain problems and the results are *not robust* to model specifications. In particular, we employ two stage Cournot duopoly model where debt, equity and capacity are chosen in the first stage and output is chosen in the second stage. In our framework firms can only obtain outside finance to finance production plans; payouts to shareholders are not allowed. In contrast to the existing literature in this area, we show firms always choose zero debt in equilibrium. The basic point is, while there are important linkages between financial structure and product market decisions, these linkages have no *real* effect on the choice of optimal capital structure of a firm.

References

1. Brander, J. and T. Lewis (1986) "Oligopoly and financial structure: the limited liability effect," *American Economic Review* **76** 956-970.

2. Campos, J. (1995) "Capital structure and product market interaction: the limited liability effect," *mimeo* CEMFI, C/Casado del Alisal, 5. 28014 Madrid, Spain.

3. Dasgupta S. and S. Titman (1996) "Pricing strategy and financial policy", *NBER Working Paper 5498* .

4. Dastidar, K.G. (1999) "Debt Financing with limited liability and quantity competition," *Seoul Journal of Economics* ***12***.

5. Dastidar, K.G. and K. Sengupta (1998) "On some implications of debt financing with limited liability," *Keio Economic Studies* **35** 45-65.

6. Dixit, A. (1980) "The role of investment in entry deterrence" *Economic Journal* **90** 95-106.

7. Faure-Grimaud, A. (2000) "Product market competition and optimal debt contracts: the limited liability effect revisited" *European Economic Review* **44** 1823-1840.

8. Glazer, J. (1994) "The strategic effects of debt," *Journal of Economic Theory* **62** 428-443.

9. Harris, M. and A. Raviv (1991) "The theory of capital structure," *Journal of Finance* **46** 297-355.

10. Maksimovic, V. (1988) "Capital structure in repeated oligopolies" *Rand Journal of Economics* **19** 389-406.

11. Modigliani, F. and M. H. Miller (1958) "The cost of capital, corporation, and the theory of investment," *American Economic Review* **48** 261-297.

12. Showalter, D. (1995) "Oligopoly and financial structure: comment," *American Economic Review* **85** 647-653.

13. Spence, M. (1977) "Entry, capacity, investment and oligopolistic pricing" *Bell Journal of Economics* **10** 1-18.